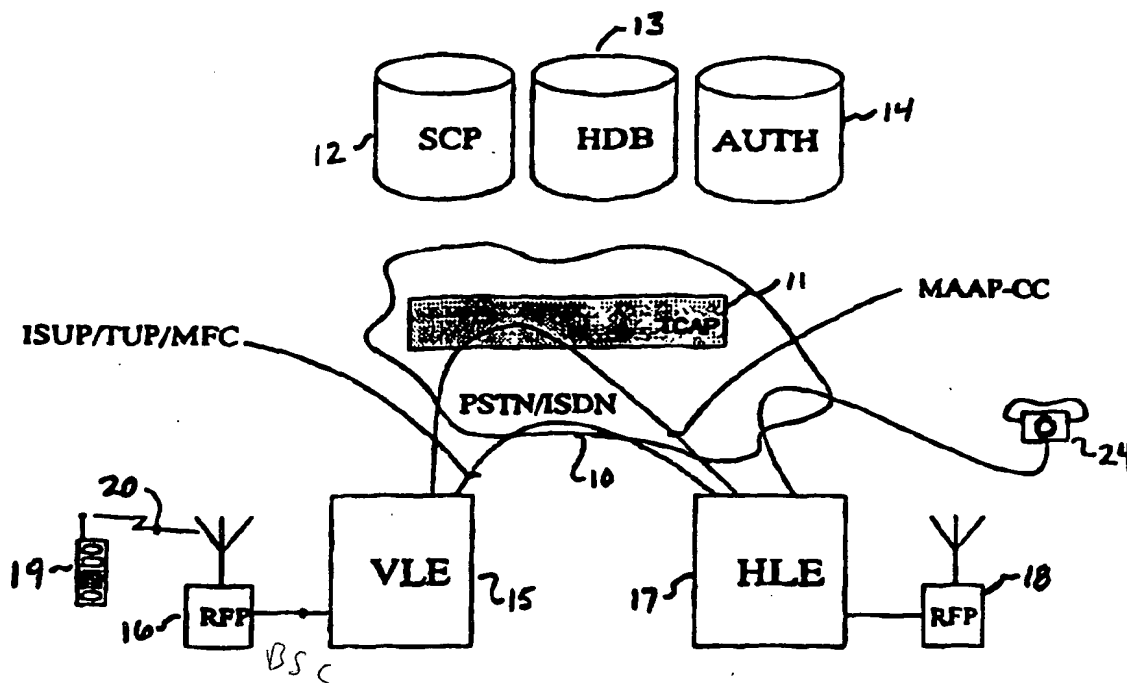




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(54) Title: MOBILE ACCESS FOR CORDLESS TERMINAL MOBILITY



## (57) Abstract

A method and apparatus for providing services to a portable terminal in a radiocommunication system are disclosed. In circumstances where the portable terminal has roamed outside the service area of a home exchange, services for that subscriber can be handled by routing both a signalling link (e.g., carrying control information from depressed keys) and a call-bearing connection back through the home exchange so that the services need not follow the subscriber. This routing can be performed when the call is initiated or after services are requested.

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**MOBILE ACCESS FOR CORDLESS TERMINAL MOBILITY****Background of the Invention****1) Field of the Invention**

5       The present invention relates to a communication network including the capability of cordless terminal communications, and, more specifically, to a method and apparatus for making available to a cordless terminal the supplementary services subscribed to in  
10   the home local exchange regardless of the physical location of the cordless terminal, i.e., no matter which exchange it is communicating with.

**2) Discussion of Related Art**

15       Since the advent of mobile radiocommunication systems, demand for these services was beyond expectations. Thus, system designers constantly face the challenge of increasing system capacity without reducing call quality below consumers tolerance levels. This challenge has been met in various  
20   creative ways. For example, digital communication systems are expected to provide a three to sevenfold increase in capacity over the original analog systems.

25       Even with the popularity enjoyed by mobile communication systems in recent years, the legacy fixed communication networks continue to be the major carriers of communications. This resulted in the more recent development of hybrid communication systems, i.e., those which are a mixture of fixed and  
30   wireless technology. In hybrid communication systems, such as Personal Communication Systems (PCS), the coverage of a fixed network is supplemented by that of a wireless network to provide both additional capacity and mobility of portable  
35   terminals. In providing these benefits, however,

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designers must confront the challenges which face the wireless industry as well as those known to fixed communication networks.

Wireless networks, for example cellular  
5 networks, must cope with various situations not found in fixed networks, such as interference and roaming. Roaming occurs when a mobile unit which is being served by a home transmitting station, passes out of the geographic region covered by that station and  
10 into an area covered by another transmitting station. If the mobile unit is in the midst of a call or connection, then a handover is needed from the home transmitting station to the new serving station. Thus a hybrid system having portable terminals which  
15 are supported via a radio link to one of a plurality of exchanges must also provide a solution for handing over calls or connections.

Another issue arises with respect to supplementary services which may be provided to  
20 subscribers using such mobile units. These supplementary services include, for example, call forwarding and call transferring, which have been prevalent in fixed communication networks for some time. Naturally, subscribers in newly developed  
25 hybrid systems will expect their portable units to provide the same functions as they enjoyed when using a fixed network or will resist the implementation of hybrid communications.

Several compatibility issues arise in hybrid  
30 systems which impact on a subscriber's ability to consistently receive supplementary services. Transmitting stations and/or exchanges which link portable terminals to the fixed part of the system can be made by different manufacturers. Different  
35 manufacturers may implement the same service in

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different ways (due to lack of standardization) which may adversely impact a mobile terminal's ability to receive services at equipment other than its home equipment. Further, services for which a subscriber  
5 has paid and receives at a home station may not be even be available at a transmitting station and/or exchange to which the portable terminal finds itself connected after roaming. These variations will cause confusion and displeasure to consumers who have  
10 consistently received a particular set of supplementary services upon demand in the conventional fixed network only to experience unreliability in the hybrid network.

One potential solution to this dilemma is to  
15 provide a consistent environment for roaming mobile users in the hybrid system. If all of the equipment experienced by such users was identical, then supplementary services could be identically provided regardless of the subscriber's geographical location.  
20 However, this option is not believed to be commercially feasible given the competitive environment in this industry.

A second solution might be to standardize the supplementary services and the ways in which these  
25 services are implemented so that even different manufacturers would produce equipment that would provide a consistent set of supplementary services to a roaming mobile. However, the standardization process of these services is unlikely to afford  
30 relief to the aforementioned problems for systems to be implemented in the near future.

The GSM, a standard used in parts of Europe for cellular communications, provides for service profiles to follow the subscriber to the exchange to  
35 which his or her equipment is connected after

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roaming. If, for example, a subscriber having access to call forwarding was to travel to an area served by an exchange other than the subscriber's home exchange, a description indicating that subscription  
5 would also be forwarded to this exchange.

#### Summary of the Invention

According to exemplary embodiments of the present invention, conventional fixed networks can be  
10 extended using wireless technology in such a way that supplementary services to which a subscriber has subscribed (e.g., call forwarding, call transfer, path replacement, call completion, call offer, do not disturb services, message services, etc.) are  
15 provided to that subscriber even when that subscriber is connected to an exchange other than its home exchange. Moreover, this can be accomplished even when the home exchange and other exchanges are not compatible in terms of the types of services which  
20 they can support.

These and other features of the present invention can be achieved by, for example, routing calls to a subscriber which has roamed into an area served by another exchange back through the home  
25 exchange. In this way, a subscriber will always have access to the services of that exchange regardless of the current geographic location of that subscriber's equipment.

According to one exemplary embodiment of the present invention, both a signalling connection and a  
30 call bearing connection are established between the visited exchange and the home exchange. According to another exemplary embodiment of the present invention, a signalling connection is established

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between the visited exchange and the home exchange,  
but the visited exchange retains the call connection.

### Brief Description of the Drawings

The invention will now be described with  
5 reference to the drawing figures in which:

Figure 1 is a functional block diagram of the  
architecture of a Personal Communications Service  
(PCS);

Figure 2 is a functional block diagram  
10 illustrating the location updating of a roaming  
Cordless Terminal Mobile (CTM) subscriber;

Figure 3 is a functional block diagram  
illustrating a first step in establishing a call  
which terminates at a CTM subscriber;

Figure 4 is a functional block diagram  
15 illustrating a second step in establishing a call  
which terminates at a CTM subscriber;

Figure 5 is a functional block diagram  
illustrating a first step in establishing a call  
20 which originates at a CTM subscriber;

Figure 6 is a functional block diagram  
illustrating a second step in establishing a call  
which originates at a CTM subscriber; and

Figure 7(a) through Figure 7(c) are exemplary  
25 flowcharts in accordance with the present invention.

### Detail Description of Preferred Embodiments

Figure 1 illustrates an exemplary PCS embodiment  
of the present invention which is provided here as an  
initial reference for describing the various  
30 connections which will be used in subsequent  
embodiments. PSTN/ISDN 10 represents a fixed network  
over which connections or calls are made. TCAP  
(Transaction Capacity Application Part) 11 handles

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exchange of protocol data units using general  
7 standardized protocol functions (to provide common  
and general system for the transfer of information  
between two nodes). SCP refers to service control  
5 point and provides the network with Intelligent  
Network Service Logic. The Home Data Base (HDB) 13  
stores information which identifies the current  
location of subscribers and supplies any requesting  
exchange in the network with this location  
10 information. It is also where the associated  
parameters of a cordless transmitter or a subscriber  
are stored. As will be later described, HDB 13 can  
be co-located with home local exchange 17 or can be  
located centrally. AUTH 14 is a repository for  
15 authentication data which can be used to authenticate  
accesses to the system.

The Visited Local Exchange (VLE) 15 is the  
exchange or switch that serves the location being  
visited by the subscriber. Although not illustrated  
20 in the Figures, those skilled in the art will readily  
appreciate that there will be many such visited local  
exchanges to which a portable terminal may be  
connected, but just one is illustrated to simplify  
the Figures. Each visited local exchange 15 has one  
25 or more base stations, called here Radio Fixed Parts  
(RFP), 16 connected thereto for providing the  
wireless transmissions for the hybrid network.

The Home Local Exchange (HLE) 17 is the exchange  
which has direct access to the HDB for a particular  
30 CTM subscriber, provides the subscriber with CTM  
service, and which may also have at least one RFP 18  
connected thereto. As will be described in more  
detail below, the home local exchange 17 continues to  
be involved in connections associated with its  
35 subscribers even when portable terminals 19 of those



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subscribers have roamed into other areas, e.g., an area served by visited local exchange 15.

Having described the major functional blocks of Figure 1, a description of the various connections illustrated by lines therebetween will now be undertaken. Portable terminals, e.g., cordless telephones such as element 19, are connected to the hybrid system over an air interface denoted by line 20. Communication over an air interface can be accomplished using any one of a number of known access techniques, such as DECT or CT2, which specify the format for wireless data communications. Those skilled in the art will readily appreciate that the selection of a particular access technique will be dictated by various design considerations such as frequency reuse, regional geography and service capabilities.

The radio fixed parts 16 and 18 are connected to their respective exchanges 15 and 17 by a link (which can be a wire link, a fiber optic link, a microwave link, etc.) using, for example, an ISDN access protocol known as DSS1. In the exemplary embodiment, the ISDN access protocol is altered. The first and second levels of the protocol (dealing with physical/electrical signal interaction and synchronization, respectively) are not so altered that the present invention can be used without substantial modification of preexisting hardware. However, only part of the third level is interpreted by the visited local exchange 15 in contrast to preexisting systems. The part of the third level which is interpreted by the visited local exchange 15 deals with directing the signal to the network. The portion of the protocol not interpreted by the visited local exchange 15 is interpreted by the home

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local exchange 17 for providing other services, including the supplemental services such as call forwarding, making transmission through the visited local exchange 15 transparent. To illustrate this difference, the protocol is marked DSS1+ in the figures.

The various connections provide the protocol for allowing the visited local exchange 15 and the home local exchange 17 to function in the cooperative manner described below. These protocols are termed herein "MAAP" (Mobile Access Application Part) protocols. MAAP-LC is a subset of this protocol which includes messages which allow the HDB 13 to keep track of and pass information on regarding, the location of an home local exchange's subscribers. This subset of protocol commands can be implemented, for example, in a manner similar to that of the GSM MAP protocols which support mobility. For reference to GSM MAP protocols, the interested reader is referred to a document entitled "GSM 9.02" Version 2 Draft, June 1992, Part III, pp. 173-226.

The MAAP-CC subset relates to call control, i.e., shifting control between the visited local exchange 15 and home local exchange 17, and can be implemented, for example, in a manner similar to that of GSM MAP commands which support inter-exchange handover. This connection provides a signalling link between the visited local exchange 15 and the home local exchange 17 as will be described in more detail below. Lastly, the MAAP-AC subset of protocols relates to commands used to empower the visited local exchange to optionally authenticate a portable terminal 19 at access.

The INAP (Intelligent Network Application Part) connections provide intelligence to the network such

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as 800 number service or premium rate service. The ISUP/TUP/MFC connection between the visited local exchange 15 and home local exchange 17 is the call bearing connection which routes the call therebetween. Having described an exemplary communication system according to the present invention, the ways in which these elements provide various functions will now be presented.

Location updating will first be described with respect to Figure 2. In order for the system to handle movement of a portable terminal from one service area to another, it is necessary for the new exchange to be alerted by the mobile of its presence. This process is commonly known as registration and will be performed in a manner based upon the particular access technology used for the air interface 20, e.g., DECT or CT2. When portable terminal 19 roams into a new location, e.g., an area serviced by visited local exchange 15, it sends a notification of its presence via the air interface 20 to the visited local exchange 15.

At this time, the visited local exchange 15 can optionally perform a terminal authentication procedure, for example using some combination of the portable terminal's identification number, electronic serial number and a counter, by using the MAAP-LC protocol and the MAAP-AC protocols. The visited local exchange 15 will then notify the HDB 13 about the new location and request the previous visited local exchange, or, if none, the home local exchange 17, to de-register the mobile terminal 19. Next, HDB 13 confirms registration with the visited local exchange 15.

According to one exemplary embodiment, the HDB 13 also sends the address of the home local exchange

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17 which supports the subscriber of the mobile terminal 19 with services to the visited local exchange 15 along with the confirmation of registration. Alternatively, the address of the home local exchange 17 associated with that subscriber can be maintained at the HDB 13 for access as needed by the visited local exchange 15. This address can be used by visited local exchange 15 to establish signalling links and/or route calls through home local exchange 17.

When a telephone call arrives at the home local exchange 17 from the fixed network 10 from, for example, unit 24, that is to be connected to a roaming subscriber, the home local exchange 17 sends a request to the HDB 13 to obtain the subscriber's location by using the MAAP-LC protocol unless the subscriber's location (i.e., visited local exchange's address) was previously returned to the home local exchange 17. The HDB 13 then returns the address of the visited local exchange 15 that the subscriber is presently visiting. The home local exchange 17 establishes a MAAP-CC session (i.e., a signalling connection) to visited local exchange 15, and notifies visited local exchange 15 about the call.

The visited local exchange 15 then returns a routing number, e.g., a directory telephone number expressed as an E.164 number, to the home local exchange 17. The home local exchange 17 establishes an ordinary, call-bearing connection to the visited local exchange 15. When the connection is completed, the visited local exchange 15 pages the subscriber's mobile terminal 19 and through-connects the answer to the home local exchange 17. The home local exchange 17 now has access to both the call and the control signals, e.g., depressed keystrokes, and can

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therefore execute any subsequent service that the subscriber may request as if the portable terminal 19 was directly connected to one of its own radio fixed parts (e.g., RFP 18).

5       The mobile terminal 19 accesses the network by sending a service request (e.g., a SETUP message) to the appropriate visited local exchange via the air interface, as illustrated in Figure 5. visited local exchange 15 then establishes a signalling connection  
10    (using MAAP-CC) to the home local exchange 17 and transfers the service request to the home local exchange 17.

15       When the home local exchange 17 has analyzed the request it sends a routing number to the visited local exchange 15 and requests the visited local exchange 15 to extend the call bearing-connection to the home local exchange 17. The visited local exchange 15 may use any available trunk signalling system that fulfills the requested transmission  
20    medium requirement (TMR) to extend the connection. The home local exchange 17 now has access to both the call and the signalling connection and can therefore offer the portable terminal 19 any service as if the portable terminal was using one of the home local  
25    exchange's own RFPs. Figure 6 illustrates that an ordinary telephone call to a subscriber can be connected anywhere in the fixed network 10.

30       Figures 7(a) through 7(c) are flowcharts of an exemplary embodiment of the invention. Figure 7(a) begins at step 70 with a portable terminal registering with a visited local exchange whose transmission range or service area it has roamed  
35    into. Thereafter, at step 71, the identity of the portable terminal 19 unit might be authenticated as an optional step. The HDB 13, which tracks the

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locations of the portable terminal, is notified as to the portable terminal's new location at step 72 through registration of the portable terminal. In turn, the home data base 13 can optionally notify the home local exchange 17 of the mobile terminal's new location, as illustrated at step 73. To avoid potential confusion, the presence of the portable terminal is de-registered from either the home local exchange 17 or another visited local exchange the service area range of which the portable terminal has left, as shown at step 74. The home local exchange's address may then be sent to the new visited local exchange so that the new visited local exchange can direct a portable terminal initiated connection to the correct address, as shown in step 75. Alternatively, the visited local exchange 15 can request this address from the HDB 13 as needed.

With reference to Figure 7(b), the procedure for call set-up from a terminal 24 connected to the home local exchange 17 to a portable terminal 19 located in a service area of a visited local exchange 15 is shown beginning at step 76. At step 77, the address of the visited local exchange 15 is obtained from the HDB 13 if not previously communicated to the home local exchange 17. Then at step 78 a MAAP-CC link is established between the home local exchange 17 and the visited local exchange 15. At step 79 the routing or telephone directory number is transmitted to the home local exchange 17 so that the visited local exchange 15 can receive the call. At block 80, the call is then connected to the visited local exchange 15. Subsequently, visited local exchange 15 pages the portable terminal 19 at step 81 and the call is put through to the home local exchange 17 at block 82. Since the home local exchange 17 now has

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both the signalling (MAAP-CC) and call connection, it can subsequently execute supplementary services as shown by block 83.

Figure 7(c) depicts an exemplary embodiment of the present invention wherein a call originates at the portable terminal 19. Therein the initial block 84 shows that a call-setup message is sent to visited local exchange 15 via RFP 16. The next step 85 establishes a MAAP-CC link between visited local exchange 15 and home local exchange 17. At block 86, a request is sent to the home local exchange 17 for a transfer of service over the MAAP-CC link. After this, a routing number from the portable terminal is sent to the visited local exchange 15. Then the call connection can be extended to the home local exchange 17. Once again, the home local exchange 17 can now provide the supplementary services to the portable terminal 19 based upon the subscriber profiles stored therein as if the portable terminal 19 was connected through RFP 18 instead of RFP 19.

Having described exemplary systems and methods for providing the capability to route calls back through a subscriber's home exchange to take advantage of the stability afforded thereby with respect to that subscriber's services, an example will now be provided in which such a service is actually invoked to complete the discussion. The following example uses the call completion-busy subscriber service, however those skilled in the art will recognize that other services can be implemented according to the present invention in a similar manner. Rather than duplicate Figures, reference is made to the elements and connections in Figure 3.

Therein, suppose that terminal 24 places a call to the portable terminal 19 through the fixed network

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10. The home local exchange 17 analyzes this number and since calls are routed via the home local exchange 15, the home local exchange 15 detects that the portable is busy.

5       Consider that the subscriber of terminal 24 has subscribed to the call completion/busy subscriber service. In this case, the user of unit 24 may invoke this service by, for example, depressing the appropriate keys. If invoked, home local exchange 17  
10 will monitor the portable terminal's original call via the signalling (MAAP-CC) link. When the portable terminal 19 is free, i.e., an on-hook signal is generated, this signal is passed back to the home  
15 local exchange 17 via the signalling link. The home local exchange 17 recognizes that it has been monitoring this portable terminal and notifies unit 24 that the call can now be completed.

      The previous exemplary embodiments have related to systems and methods wherein both the signalling  
20 and call-bearing connections are routed back through the home local exchange 17. However, there may be situations in which it is desirable to maintain call-bearing responsibilities in the visited local  
exchange 15 and make only a signalling connection  
25 with the home local exchange 17. For example, it may be the case that the service to be invoked by the subscriber will involve transferring the call to another user whose equipment is proximate the visited  
local exchange 15. Exemplary embodiments in  
30 accordance with this aspect of the present invention will now be described.

      First, a call originating from the portable terminal will be described. As in previous  
embodiments, the portable terminal accesses the  
35 network by sending a request for connection to the



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nearest exchange (visited local exchange 15) via the  
air interface. The visited local exchange 15  
analyses the number and establishes a signalling link  
to the home local exchange 17. The home local  
5 exchange 17 analyzes the dialled number, for example  
using an external database, to determine what the  
number would be if dialled in the visited local  
exchange 15. This number is then sent back to the  
visited local exchange 17 in order to extend the  
10 call-bearing connection.

The visited local exchange 15 uses any available  
trunk signalling system that fulfills the requested  
TMR (transmission medium requirement) when extending  
the connection to the dialed number. It also  
15 monitors the call and sends progress information  
(ringing, answer) back to the home local exchange 17  
via the signalling link. Note that according to this  
exemplary embodiment the home local exchange 17 only  
has access to the signalling link rather than both  
20 the signalling link and the call-bearing connection.  
Instead, the call-bearing connection is optimized to  
travel, for example, a shortest path between the  
visited local exchange 15 and the called subscriber  
in the fixed network.

25 For connections which terminate at the portable  
terminal when it is connected to the visited local  
exchange 15, the operation of this system can, for  
example, be as follows. When the portable terminal  
roams into the area served by the visited local  
30 exchange 15, it sends a notification to the visited  
local exchange 15 about its presence. The visited  
local exchange 15 in turn notifies the portable  
terminal's the home data base 13 about the  
subscriber's whereabouts. To this point, the  
35 operation is similar to that described above with

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respect to the embodiment of Figure 2. Now reference is made to Figure 8.

When a call arrives to, for example, a gateway local exchange (GLE) 26 that is bound for the roaming subscriber, that exchange sets up a signalling link (MAAP-CC connection) to the home local exchange 17 requesting further directives. The home local exchange 17 sets up a call to the visited local exchange 15 requesting it to locate the portable terminal 19. The visited local exchange 15 pages the portable terminal and, if this is successful, an E.164 number (routing or telephone number) is returned to the home local exchange 17 that enables it to establish a signalling connection to the portable mobile through the visited local exchange 15.

Next, the home local exchange 17 sends the received number to the exchange serving the calling equipment which uses that information to establish the call-bearing connection in an optimal manner, e.g., shortest path, to the portable terminal. Note that this frequently means that the call-bearing connection will not be directed through the home local exchange 17.

Having described the basic connection premise whereby a signalling connection and a call-bearing connection are separately established, the way in which services can be invoked according to this embodiment will now be discussed. When a service request is received, the home local exchange 17 requests the visited local exchange 15 and the exchange serving the other connected party to change the call-bearing connection such that it passes through the home local exchange 17 by providing appropriate numbers (e.g., E.164 numbers) for this

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routing. In this way, the home local exchange 17 again possess both the signalling connection and the call-bearing connection so that services can be implemented by the home local exchange 17 and the consumer transparently experiences those services in a stable manner.

The invention described herein includes variations thereof. The described embodiment is to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and all changes within the meaning and range of equivalency of the claim recitations are intended to be embraced therein.

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WHAT IS CLAIMED IS:

1           1.    A method of providing mobile access for  
2   portable terminal mobility in a system having a home  
3   exchange storing a profile of user attributes  
4   associated with a given subscriber of a portable  
5   terminal, at least one visited exchange which is not  
6   required to store user attributes of said subscriber  
7   and to which is operatively connected a fixed radio  
8   transceiver, said method comprising the steps of:  
9            originating a call at the portable terminal  
10   when a portable terminal attempts to establish  
11   communication with another terminal, said originating  
12   step including the steps of  
13            sending from the portable terminal a  
14   service request to a visited exchange;  
15            establishing a signalling connection  
16   between the visited exchange and the home exchange;  
17            transferring the service request to the  
18   home exchange over the signalling connection;  
19            sending from said portable terminal a  
20   routing number to the visited exchange;  
21            establishing a communication connection to  
22   the home exchange;  
23            supplying to the portable terminal  
24   requested supplementary services from the home  
25   exchange.

1           2.    A method of providing mobile access for  
2   portable terminal mobility in a system having a home  
3   exchange storing a profile of user attributes  
4   associated with a given subscriber of a portable  
5   terminal, at least one visited exchange which is not  
6   required to store user attributes of said subscriber

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7 and to which is operatively connected a fixed radio  
8 transceiver, said method comprising the steps of:  
9 setting up a call from the home exchange to a  
10 portable terminal located in a service area of a  
11 visited exchange when a calling terminal attempts to  
12 establish communication with said portable terminal,  
13 said setting up step including the steps of  
14 obtaining an address of said visited  
15 exchange in which the portable terminal is located;  
16 establishing a signalling connection  
17 between the home exchange and the visited exchange  
18 based on said address;  
19 transmitting a routing number to the home  
20 exchange;  
21 establishing a communications connection  
22 between the visited exchange and the home exchange;  
23 paging said portable terminal from the  
24 visited exchange;  
25 extending said communications connection to  
26 said portable terminal from the visited exchange; and  
27 executing requested supplementary services  
28 from said home exchange.

1 3. A method in accordance with claim 2,  
2 wherein said step of obtaining an address of said  
3 visited exchange in which the portable terminal is  
4 located includes the further steps of locating the  
5 portable terminal including registering the portable  
6 terminal with a visited exchange when said portable  
7 terminal enters a service area of a visited exchange.

1 4. A method in accordance with claim 3,  
2 wherein said locating step includes the further step  
3 of notifying a home data base, which tracks locations

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4 of the portable terminals, as to the portable  
5 terminal's new location.

1       5. A method in accordance with claim 4,  
2 wherein said locating step includes the further step  
3 of authenticating the identity of the portable  
4 terminal prior to notifying the home data base.

1       6. A method in accordance with claim 4,  
2 wherein said step of obtaining an address of said  
3 visited exchange in which the portable terminal is  
4 located includes accessing the home data base.

1       7. A method in accordance with claim 3,  
2 wherein said locating step includes de-registering  
3 the presence of the portable terminal from a exchange  
4 a service area of which the portable terminal has  
5 left.

1       8. A method in accordance with claim 2,  
2 comprising the further steps of:  
3       originating a call at the portable terminal  
4 when a portable terminal attempts to establish  
5 communication with another terminal, said originating  
6 step including the steps of  
7       sending a service request to a visited  
8 exchange from a portable terminal;  
9       establishing a signalling connection  
10 between the visited exchange and the home exchange;  
11       transferring the service request to the  
12 home exchange over the signalling connection;  
13       sending from said home exchange a routing  
14 number to the visited exchange;

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15           establishing a communication connection  
16   between the portable terminal and the home exchange;  
17   and  
18           providing to the portable terminal  
19   requested supplementary services from the user  
20   profile stored in the home exchange.

1           9.   A method of providing mobile access for  
2   portable terminal mobility in a system having a home  
3   exchange storing a profile of user services  
4   associated with a given subscriber of a portable  
5   terminal, at least one visited exchange which is not  
6   required to store user services of said subscriber  
7   and to which is operatively connected a fixed radio  
8   transceiver, said method comprising the steps of:  
9           originating a call at the portable terminal  
10   when a portable terminal attempts to establish  
11   communication with another terminal, said originating  
12   step including the steps of  
13           sending a service request, which includes a  
14   dialled number, to a visited exchange;  
15           establishing a signalling connection  
16   between the visited exchange and the home exchange  
17   according to the service request;  
18           transferring the service request to the  
19   home exchange over the signalling connection;  
20           analyzing the service request in the home  
21   exchange to determine what the dialled number would  
22   be if dialled in the visited exchange;  
23           sending the determined dialled number back  
24   to the visited exchange;  
25           establishing a communication connection in  
26   the visited exchange to the dialled number according  
27   to the determine dialled number; and

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28                   supplying to the portable terminal  
29 requested supplementary services from the home  
30 exchange over the signaling connection.

1           10. A method of providing mobile access for  
2 portable terminal mobility in a system having a home  
3 exchange storing a profile of user attributes  
4 associated with a given subscriber of a portable  
5 terminal, at least one visited exchange which is not  
6 required to store user attributes of said subscriber  
7 and to which is operatively connected a fixed radio  
8 transceiver, said method comprising the steps of:  
9           setting up a call from a third exchange to a  
10 portable terminal located in a service area of a  
11 visited exchange when a calling terminal connected to  
12 the third exchange attempts to establish  
13 communication with said portable terminal, said  
14 setting up step including the steps of  
15           receiving a service request in the home  
16 exchange for the third exchange;  
17           obtaining in the home exchange an address  
18 of said visited exchange in which the portable  
19 terminal is located;  
20           establishing a signalling connection  
21 between the home exchange and the visited exchange  
22 based on said address;  
23           paging said portable terminal from the  
24 visited exchange;  
25           when paging is successful, returning to the  
26 home exchange a routing number of the portable  
27 terminal for establishing a signalling connection to  
28 the portable terminal through the visited exchange;  
29           forwarding the returned routing number to  
30 the third exchange;



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31           establishing, separate from signalling  
32 connection, an optimal communications connection  
33 between the portable unit and the third exchange; and  
34           executing requested supplementary services  
35 from said home exchange over the signalling  
36 connection.

1           11. A method in accordance with claim 10,  
2 wherein said step of obtaining an address of said  
3 visited exchange in which the portable terminal is  
4 located includes the further steps of locating the  
5 portable terminal including registering the portable  
6 terminal with a visited exchange when said portable  
7 terminal enters a service area of a visited exchange.

1           12. A method in accordance with claim 11,  
2 wherein said locating step includes the further step  
3 of notifying a home data base, which tracks locations  
4 of the portable terminals, as to the portable  
5 terminal's new location.

1           13. A method in accordance with claim 12,  
2 wherein said locating step includes the further step  
3 of authenticating the identity of the portable  
4 terminal prior to notifying the home data base.

1           14. A method in accordance with claim 12,  
2 wherein said step of obtaining an address of said  
3 visited exchange in which the portable terminal is  
4 located includes accessing the home data base.

1           15. A method in accordance with claim 11,  
2 wherein said locating step includes de-registering  
3 the presence of the portable terminal from a exchange

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4 a service area of which the portable terminal has  
5 left.

1 16. A method of providing mobile access for  
2 mobile terminal mobility in a system having at least  
3 one home exchange storing a profile of supplemental  
4 services associated with a given subscriber of a  
5 mobile terminal, at least one visited exchange which  
6 is not required to store supplemental services of  
7 said subscriber and to which is operatively connected  
8 a fixed radio transceiver, said method comprising the  
9 steps of:

10 establishing communication between said  
11 mobile terminal and said fixed radio transceiver  
12 operatively connected to said visited exchange; and  
13 transparently communicating through said at  
14 least one visited exchange to communicate with said  
15 home exchange by use of a protocol of which a portion  
16 is send to the home exchange without being  
17 interpreted by the visited exchange so that said user  
18 attributes are available to the portable terminal  
19 from said home exchange.

1 17. A communication system for providing  
2 services to a subscriber's equipment comprising:  
3 a fixed communication network;  
4 a home exchange connected to said fixed  
5 communication network and including a memory for  
6 storing subscriber profile information corresponding  
7 to said subscriber's equipment;  
8 a home data base for storing information  
9 indicating a location of said subscriber's equipment;  
10 a visited exchange connected to said fixed  
11 communication network and to said subscriber's  
12 equipment via an air interface;

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13 means for establishing, through said fixed  
14 communication network, a signalling link between said  
15 home exchange and said visited exchange;

16 means for establishing, through said fixed  
17 communication network and separate from said  
18 signalling link, a communication link between a third  
19 exchange and said visited exchange; and

20 means for switching connections between  
21 said subscriber's equipment and said fixed network  
22 through said home exchange to provide said services  
23 using said subscriber profile information.

1 18. A system comprising:

2 a portable terminal;

3 a home exchange associated with said  
4 portable terminal;

5 a visited exchange currently serving said  
6 portable terminal;

7 a gateway exchange serving another  
8 terminal;

9 means for establishing a first signalling  
10 link between said visited exchange and said home  
11 exchange and a second signalling link between said  
12 gateway exchange and said home exchange when a call-  
13 bearing connection is requested between said portable  
14 terminal and said another terminal; and

15 means for establishing said call-bearing  
16 connection between said visited exchange and said  
17 gateway exchange.

1 19. The system of claim 18 wherein said home  
2 exchange further comprises:

3 means for monitoring said first and second  
4 signalling links and routing said call-bearing  
5 connection via said home exchange when a service is

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6 requested that requires information stored at said  
7 home exchange.

1           20. The system of claim 18 wherein said home  
2 exchange further comprises:  
3           means for monitoring said first and second  
4 signalling links and routing said call-bearing  
5 connection via said home exchange when a service is  
6 requested.

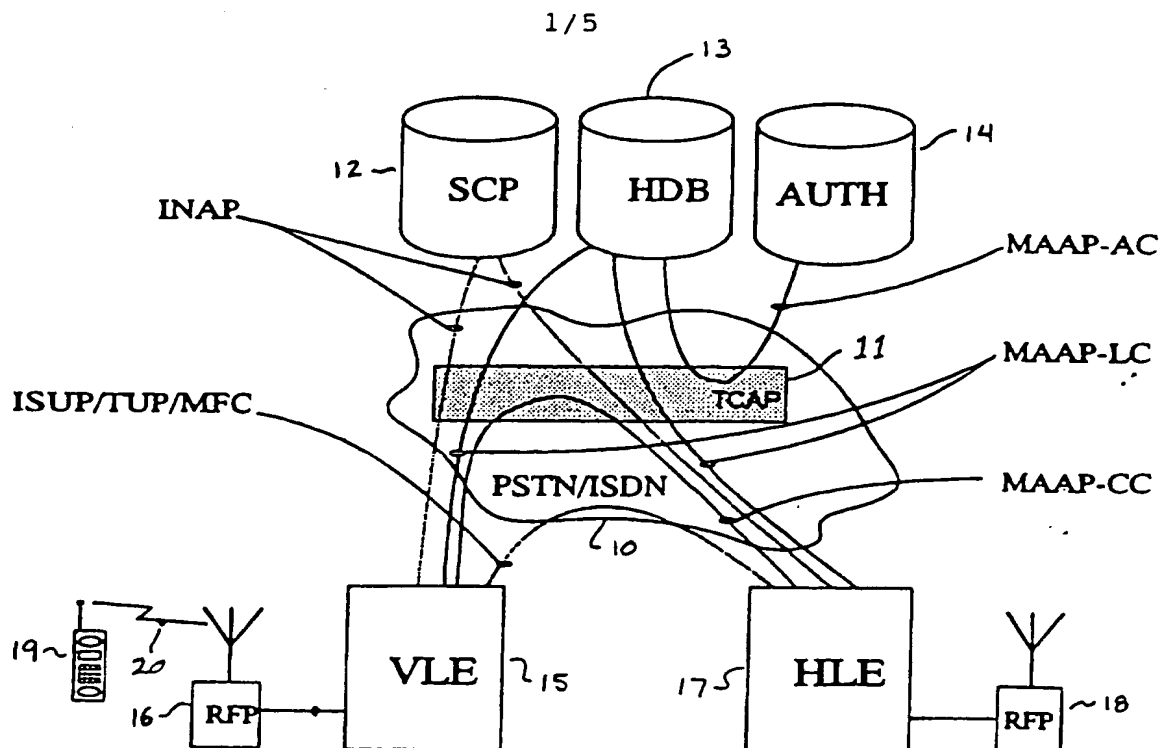


Fig. 1

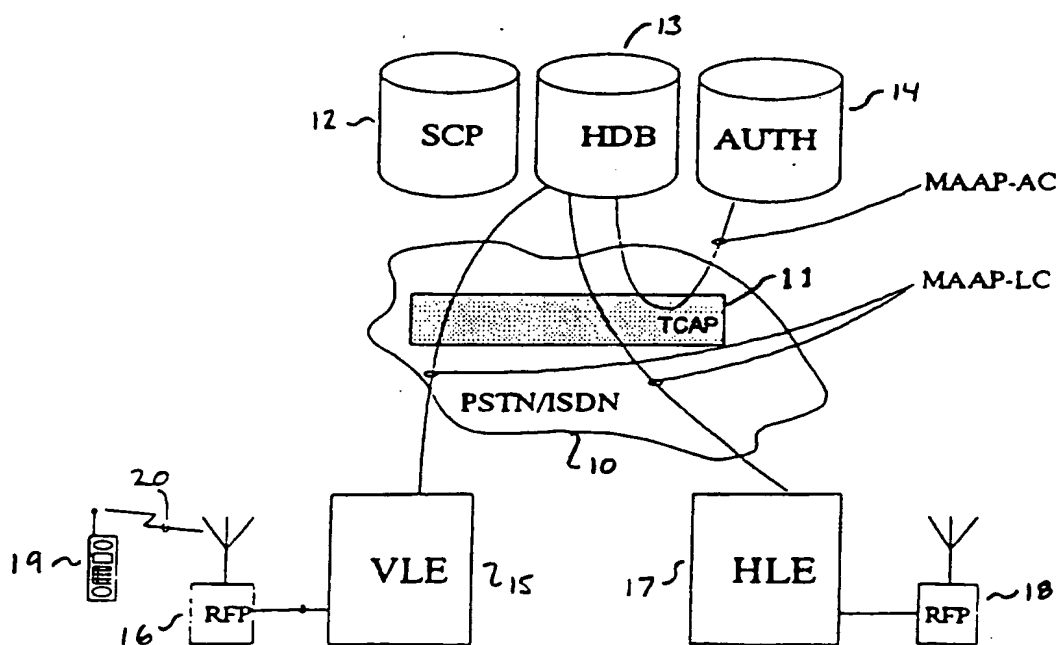


Fig. 2

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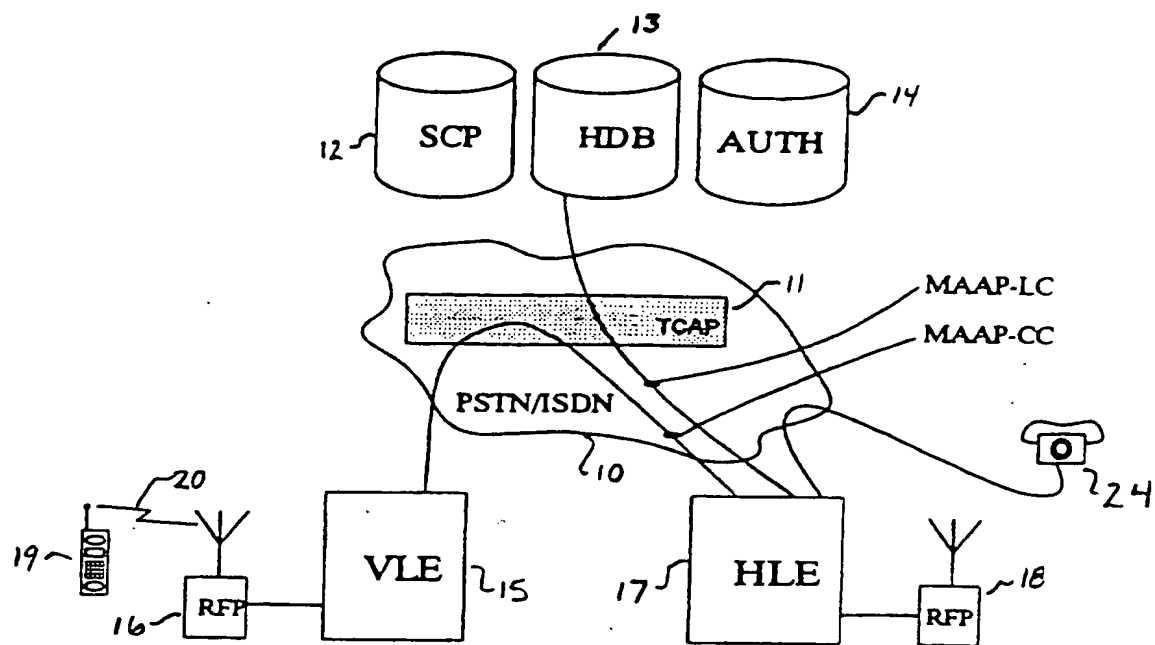


Fig. 3

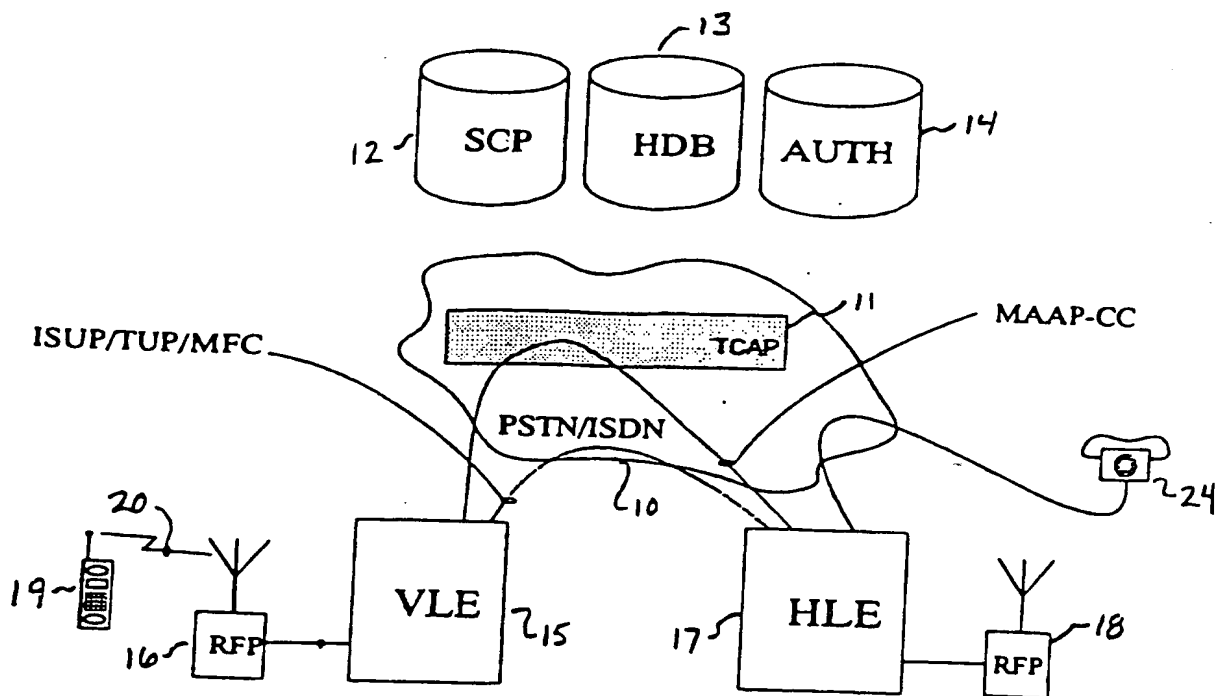


Fig. 4

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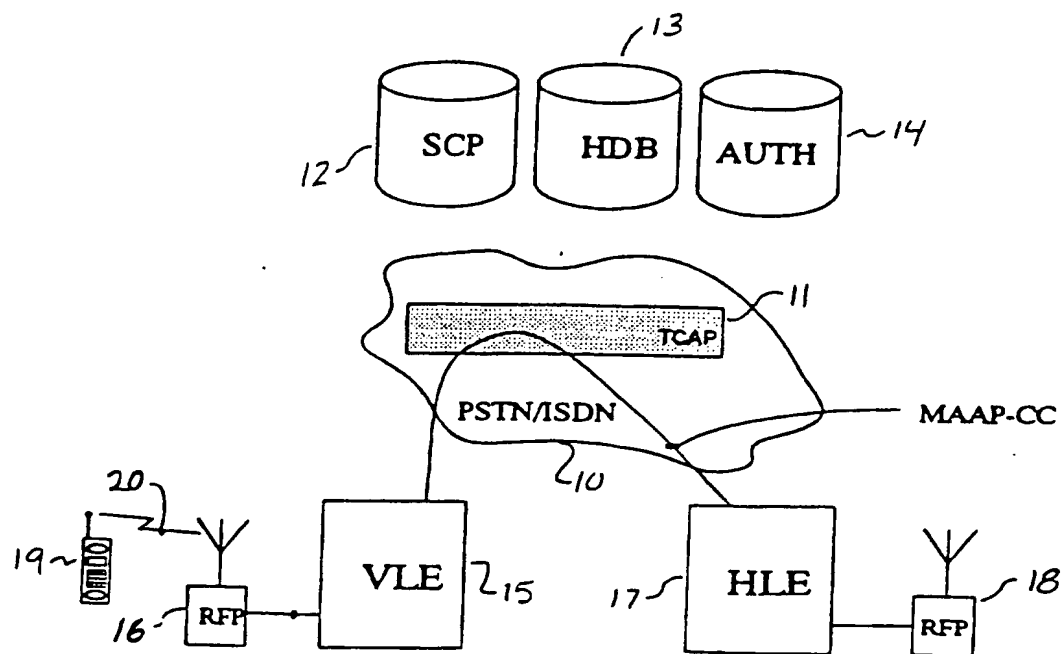


Fig. 5

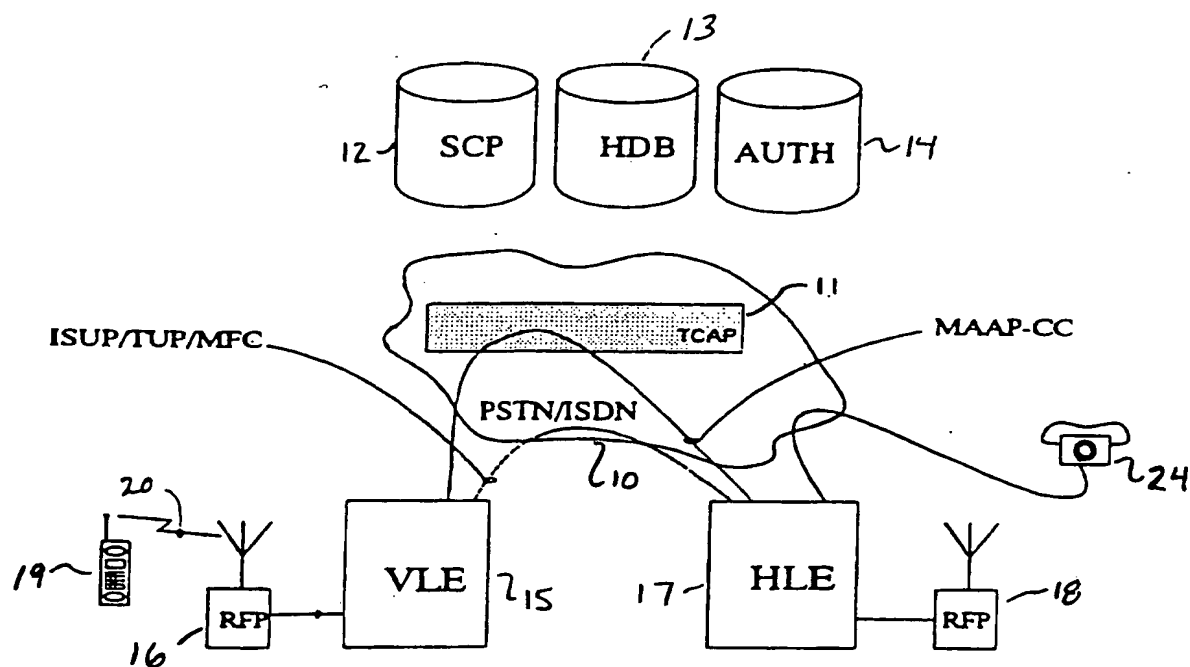


Fig. 6

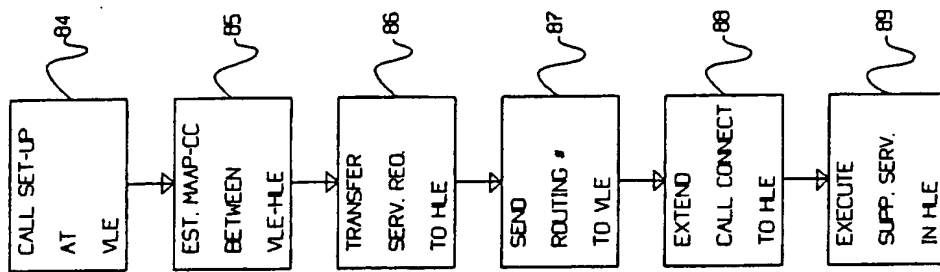


FIG. 7(c)

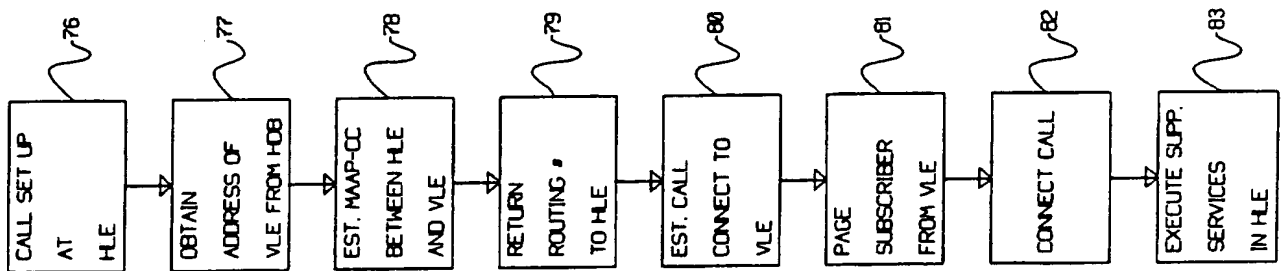


FIG. 7(b)

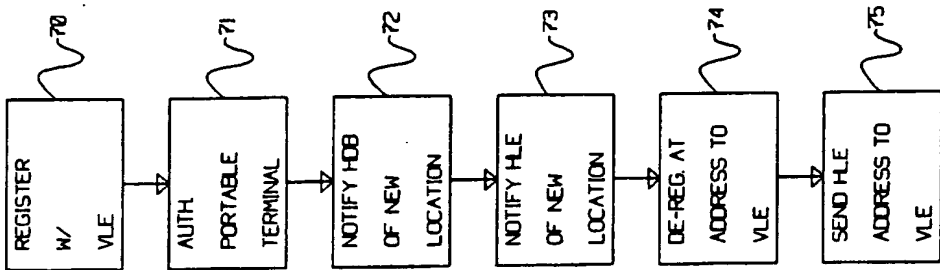


FIG 7(a)



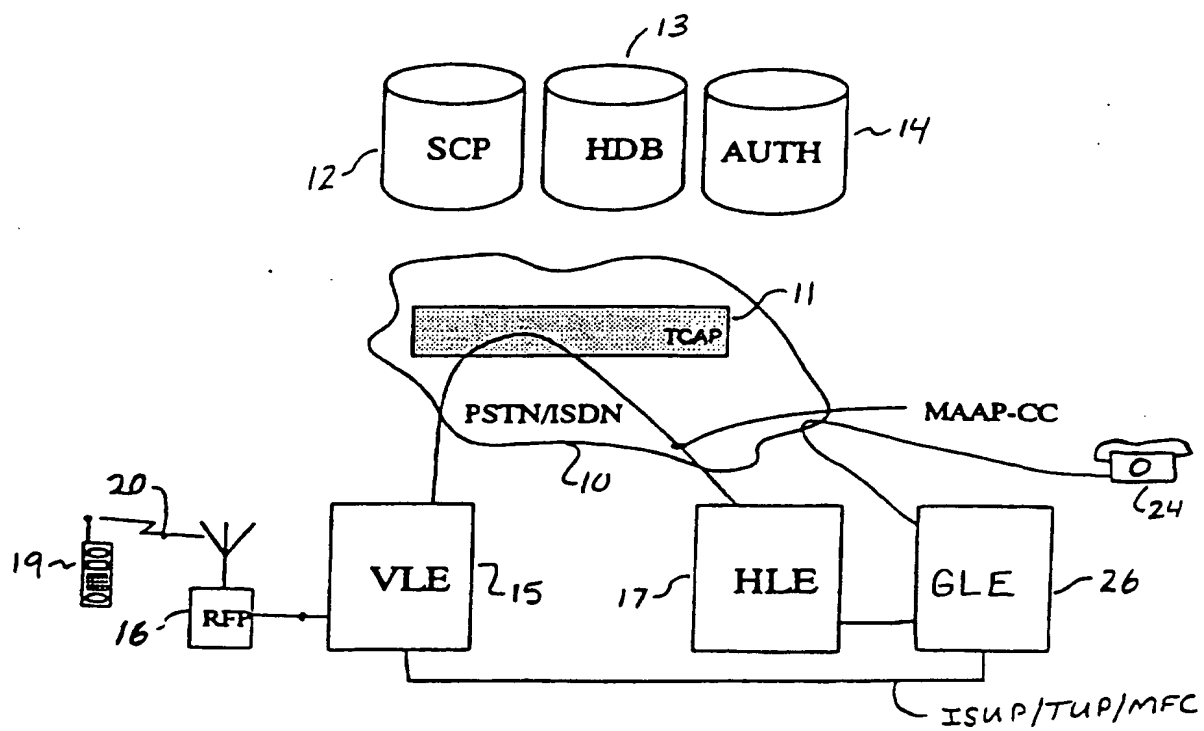


Fig. 8

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/24

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## WPI, CLAIMS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9318606 a1 (BELL ATLANTIC NETWORK SERVICES, INC.) 16 September 1993, see page 7, line 12 - line 18; page 7, line 22 - line 27; page 8, line 3 - line 21; page 11, line 9 - line 26; page 13, - line 1 - line 8, page 13, line 16 - page 14, line 32, page 15, line 1 - page 17, line 2, page 17, line 20 - line 24, page 69, line 3 - line 18. --	1,2,9-10, 16-18
X	US 5291544 A (H.P.J. HECKER), 1 March 1994 (01.03.94), column 1, line 32 - line 58; column 2, line 1 - line 9 --	1,2,9,10, 16-18
X	WO 9405129 A1 (TELEFONAKTIEBOLAGET L M ERICSSON), 3 March 1994 (03.03.94), abstract --	10,17,18

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

- \* Special categories of cited documents
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- "E" earlier document but published on or after the international filing date
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- "P" document published prior to the international filing date but later than the priority date claimed

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- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 February 1996	16 -02- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  Marcus Wik Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/01431

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5142654 A (K.W. SONBERG ET AL), 25 August 1992 (25.08.92), column 1, line 63 - line 67 --	9
A	EP 0605120 A1 (AT & T CORP), 6 July 1994 (06.07.94) -- -----	1-20

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

05/01/96

International application No.

PCT/SE 95/01431

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			CA-A,C-	2026596	04/04/91
			DE-D,T-	69015094	22/06/95
			EP-A,B-	0421535	10/04/91
			SE-T3-	0421535	
			ES-T-	2066959	16/03/95
			JP-A-	3135194	10/06/91
			NL-A-	8902453	01/05/91
			NO-B,C-	176859	27/02/95
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WO-A1-	9405129	03/03/94	NONE		
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EP-A1-	0605120	06/07/94	NONE		
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